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PROCEEDINGS
OF
THE ROYAL SOCIETY.

1830-1831.

No. 1.

November 18.

DAVIES GILBERT, Esq. President, in the Chair.

The following Presents were received, and thanks ordered for them :—

Transactions of the Royal Irish Academy, Vol. XVI. Part I. 4to.
—*Presented by the Academy.*

Transactions of the Royal Asiatic Society, Vol. II. 4to.—*The Society.*

Medico-Chirurgical Transactions, published by the Medical and
Chirurgical Society of London, Vol. XVI. 8vo.—*The Society.*

The Quarterly Journal of Science, No. 14, New Series. 8vo.—*The
Managers of the Royal Institution.*

The Journal of the Royal Institution. No. 1. 8vo.—*The Same.*

The Philosophical Magazine and Annals of Philosophy. By R.
Taylor, F.L.S. and R. Phillips, F.R.S. Nos. 43-47. 8vo.—*The
Editors.*

The Zoological Journal, No. 18. 8vo.—*The Editors.*

The Edinburgh Journal of Natural and Geographical Science.
Nos. 10-12 : with Supplement to No. 12. 8vo.—*The Editors.*

Gill's Scientific, Technological and Microscopic Repository. No. 37.
8vo.—*The Editor.*

Monthly Notices of the Proceedings of the Astronomical Society.
Nos. 26-28. 8vo.—*The Society.*

The London Literary Gazette. Nos. 700-721. 4to.—*The Proprie-
tors.*

The National Portrait Gallery of Illustrious and Eminent Per-
sonages of the Nineteenth Century. By Wm. Jerdan, Esq. Nos.
15-19. 8vo.—*The Proprietors.*

Astronomical Observations made at the Observatory of Cambridge.
Vol. II. (1829).—*Professor Airy.*

Mémoires de l'Académie Royale des Sciences de l'Institut de
France, Tome IX.—*The Academy.*

Flora Batava. No. 85-86. 4to.—*His Majesty the King of the Ne-
therlands.*

- Transactions of the American Philosophical Society, held at Philadelphia for promoting Useful Knowledge. Vol. III. Part II. New Series. 4to.—*The Society*.
- Memorias para servir de Introduccion á la Horticulura Cubana. Por D. Ramon de la Sagra. 8vo.—*The Editor*.
- Anales de Ciencias, Agricultura, Comercio y Artes. Tomo segundo. Por Don Ramon de la Sagra. 8vo.—*The Editor*.
- A Short Tract on the Formation of Tumours, and the Peculiarities that are met with in the Structure of those that have become Cancerous; with their Mode of Treatment. By Sir Everard Home, Bart. V.P.R.S. 8vo.—*The Author*.
- A Rationale of the Laws of Cerebral Vision; comprising the Laws of Single and of Erect Vision, deduced upon the principle of Dioptrics. By John Fearn, Esq. 8vo.—*The Author*.
- Lectures on Anatomy: interspersed with practical Remarks. Vol. II. By Bransby Blake Cooper, Esq. F.R.S.—*The Author*.
- Cases illustrative of the efficacy of various Medicines administered by Inhalation, in Pulmonary Consumption; in certain morbid states of the Trachea and Bronchial Tubes, attended with distressing Cough; and in Asthma. By Sir Charles Scudamore, M.D. F.R.S. 8vo.—*The Author*.
- Mayer's Catalogue of Stars, corrected and enlarged; together with a Comparison of the Places of the greater part of them, with those given by Bradley; and a reference to every observation of every Star. By Francis Baily, Esq. F.R.S. folio.—*The Author*.
- Supplement to an Essay on the Theory of Systems of Rays. By Wm. R. Hamilton, Esq. A.R. of Ireland. 4to.—*The Author*.
- An Analytical System of Conic Sections. Second Edition, improved and enlarged. By the Rev. H. P. Hamilton, M.A. F.R.S. 8vo.—*The Author*.
- The First Book of Euclid's Elements; with alterations and familiar Notes. Being an attempt to get rid of Axioms altogether; and to establish the theory of Parallel Lines, without the introduction of any principle not common to other parts of the Elements. Third Edition. By Lieut.-Col. T. P. Thompson, M.A. F.R.S. 8vo.—*The Author*.
- Observations, deduced from Experiment, upon the Natural Water-Cements of England, and on the Artificial Cements that may be used as substitutes for them. By Lieut.-Colonel C. W. Pasley. F.R.S. 8vo.—*The Author*.
- An Answer to certain Statements contained in Mr. Neill's "Address to the Members of the Wernerian Natural History Society." By H. H. Cheek, Esq. 8vo.—*The Author*.
- The Stars, in Six Maps, laid down according to the Gnomonic Projection. Published under the superintendence of the Society for the Diffusion of Useful Knowledge. 4to.—*The Society*.
- Catalogue of the Contents of the Museum of the Royal College of Surgeons in London. Part IV. Fasciculus I. comprehending the first division of the preparations of Natural History in Spirit. 4to.—*The College*.

- Catalogue of the Printed Books in the Royal Asiatic Society's Library ; and Third Report of the Oriental Translation Committee. 4to.—*The Society*.
- A Catalogue of the Library of the London Institution : with a Supplement. 8vo.—*The Institution*.
- An Engraved Portrait of the late W. H. Wollaston, M.D. V.P.R.S. —*Mr. W. Skelton*.
- A Print of the Vivarium in the Garden of Joshua Brookes, Esq. —*Joshua Brookes, Esq. F.R.S.*
- The Fifty-sixth Annual Report of the Royal Humane Society. 8vo. —*The Society*.
- A Catalogue of the Fellows, Candidates, and Licentiates of the Royal College of Physicians (1830). 8vo.—*The College*.
- Théorie des Nombres. Troisième Edition. Par Adrien-Marie Le Gendre. 4to.—*M. Le Gendre, Foreign Memb. R.S.*
- Théorie des Phénomènes Electro-dynamiques, uniquement déduite de l'Expérience. Par André-Marie Ampère. 4to.—*M. Ampère, Foreign Memb. R.S.*
- Mémoire sur l'Action mutuelle d'un Conducteur Voltaïque et d'un Aimant. Par M. Ampère. 4to.—*The Author*.
- Mémoire sur la détermination de la surface courbe des Ondes Lumineuses dans un milieu, dont l'Elasticité est différente, suivant les trois directions principales, c'est-à-dire celles où la force produite par l'Elasticité a lieu dans la direction même du déplacement des Molécules de ce milieu. Par M. Ampère. 8vo.—*The Author*.
- Expériences sur le Mouvement des Fluides Aériformes et des Liquides. Par M. Hachette. 8vo.—*The Author*.
- Recueil d'Observations Médicales confirmant la doctrine de Du-camp sur la Cautérisation de l'Urètre ; précédé d'un Abrégé de l'Histoire de la Cautérisation de l'Urètre en France. Par M. P. L. A. Nicod. Tome Premier. 8vo.—*The Author*.
- Mémoire sur les Polypes de l'Urètre et de la Vessie. Par M. Nicod. 8vo.—*The Author*.
- Extrait d'un Ouvrage inédit, intitulé, Traitement des Maladies de l'Oreille moyenne qui engendrent la Surdité ; précédé de Rapports à l'Académie Royale des Sciences. Par le Docteur Deleau, Jeune. 8vo.—*The Author*.
- Notice sur les Collections Numismatiques de M. P. F. J. Gossellin. Par M. Raoul-Rochette. 8vo.—*The Author*.
- Principes Fondamentaux de l'Equilibre et du Mouvement des Corps Flottans dans deux milieux résistans. Par P. J. Moreau. 4to. —*The Author*.
- Oryctographie du Gouvernement de Moscou, publiée par le Directeur de la Société Impériale des Naturalistes de Moscou. Par Gotthelf Fischer-de-Waldheim. folio.—*The Author*.
- Notice sur le Tettigopsis, nouveau genre d'Orthoptères de la Russie. Par G. Fischer-de-Waldheim. 4to.—*The Author*.

A Paper was read, entitled, "On the nature of negative and imaginary quantities." By Davies Gilbert, Esq. President of the Royal Society.

The object of this paper, the author observes, is one that has given rise to much controversy, and has been involved in much unnecessary mystery. Paradoxes and apparent solecisms, when involved with facts and indubitable truths, will always be found, upon accurate examination, to be near the surface, and to owe their existence either to ambiguities of expression, or to the unperceived adoption of some extraneous additions or limitations into the compound terms employed for definition, and which are subsequently taken as constituent parts of their essence.

The first misapprehension pointed out, is that of considering any quantity whatever as *negative per se*, and without reference to another opposed to it, which has previously been established as *positive*. In order to avoid previously formed associations of ideas, the author prefers employing in his reasonings on this subject, the symbols (*a*) and (*b*) to express this quality of opposition, rather than the usual ones of *plus* and *minus*. By the aid of this notation he is enabled to present, in its full generalization, the law of the signs in multiplication,—a process which, it is well known, is founded solely upon the principle of ratios; and to show that like signs invariably give the sign belonging to the assumed unity, or universal antecedent of the ratios; and unlike signs, the contrary.

Since either the one or the other of the arithmetical scales derived from the two unities is in itself equally affirmative, but negative with relation to the other, it follows, that by using the scale of (*b*), all even roots in the scale of (*a*) will become imaginary, and thus the apparent discrimination of the two scales is removed; so that the properties belonging to the two scales are interchangeable, and all formulæ become universally applicable to both, by changing the signs according to the side in which the universal antecedent is taken. Imaginary quantities, then, are merely creations of arbitrary definitions, endowed with properties at the pleasure of him who defines them; and the whole dispute respecting their essence turns upon the very point that has been contested from the earliest times, between the hostile sects of realists and nominalists.

It is now, however, universally agreed, that all abstractions and generalizations are mere creatures of the reasoning faculty, existing nowhere but in the mind contemplating them. Such, in algebra, are the supposed even roots of a real quantity, taken in the scale opposite to that which has given the universal antecedent: the sign indicating the extraction impossible to be performed, veils the real quantity, and renders it of no actual value until the sign is taken away by an involution, the reverse of the supposed operation which the sign represents; although the quantity itself is, in the mean time, by its arbitrary essence, made applicable to all the purposes for which real quantities are used, in every kind of formula.

Several illustrations of these views of the nature of imaginary

quantities occurring in logarithmic formulæ, and series expressing circular arcs, are given by the author. By considering all quantity as affirmative *per se*, and admitting *plus* and *minus* merely as correlative terms, we thus succeed in banishing mystery and paradox from the science most powerful in eliciting truth, and where they ought least to find a place.

November 25.

DAVIES GILBERT, Esq. President, in the Chair.

The following Presents were received, and thanks ordered for them :—

Transactions of the Plymouth Institution. 8vo.—*Presented by the Institution.*

Illustrations of Indian Zoology; consisting of coloured Plates of new, or hitherto unfigured, Indian Animals, from the collection of Major-general Hardwicke, F.R.S. Selected and arranged by John Edward Gray. folio.—*John E. Gray, Esq.*

Monthly Notice of the Proceedings of the Astronomical Society. No. 29. 8vo.—*The Society.*

Ireland and its Economy; being the result of Observations made in a Tour through the Country in the Autumn of 1829. By James E. Bicheno, Esq. F.R.S. 8vo.—*The Author.*

The Elements of the Theory of Mechanics. By the Rev. Robert Walker, M.A. 8vo.—*The Author.*

The London Literary Gazette. No. 722. 4to.—*The Proprietors.*

An Engraved Portrait of John Dalton, Esq. F.R.S.—*Joseph Allen, Esq.*

Mémoires présentés par divers Savans à l'Académie Royale des Sciences de l'Institut de France, et imprimés par son ordre. (Sciences Mathématiques et Physiques.) Tome deuxièm. 4to. 1830.—*The Academy.*

Astronomische Beobachtungen auf der Königlichcn Universitäts-Sternwarte in Königsberg. 13 u. 14 Abtheilungen. Von F. W. Bessel, Ritter, u. s. w. folio.—*Professor Bessel, Foreign Memb. R.S.*
Annalen der K. K. Sternwarte in Wien. Nach dem Befehle Seiner Majestät, auf Oeffentliche Kosten, herausgegeben. Von J. J. Littrow und Lambert Mayer. Zehnter Theil. folio.—*Professor Littrow.*

A Paper was read, entitled, "On a simple electro-chemical method of ascertaining the presence of different metals; applied to detect minute quantities of metallic poisons." By Edmund Davy, Esq. F.R.S., M.R.I.A., and Professor of Chemistry to the Royal Dublin Society.

The Voltaic arrangement employed by the author consisted merely of small slips of different metals, generally zinc and platina, placed in contact and forming a galvanic circuit with the inter-